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BOTANY IN THE CITY HIGH SCHOOLS*

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Just at present high school biology in general and high school botany in particular are in a very critical position. The cause I believe is both external and internal, but largely external. Prejudice, the child of ignorance, jealousy, and even patriotism, strange as it may seem, are among the forces that are working against us from the outside. While from the inside our failure to recognize the changed conditions existing in our high schools, due to a certain complacency and false sense of security in the standing and permanency of our subject, has left us in a precarious situation.

To be more specific: I shall try briefly to outline what I consider the external situation and the internal conditions that I have just enumerated, and to point out, if I may, a few remedies that may relieve the situation and bring botany back into its own in the New York City high schools.

First as to prejudice and ignorance, which are practically the same thing. I heard an eminent physician say the other evening that the layman's knowledge of medicine was always one generation behind that of the specialists. And so in high school botany we are accused by people who really ought to know better, of teaching a kind of botany that was in vogue twenty years ago, and which we never think of teaching now. Their idea of botany is what they themselves studied years ago. It consisted of memorizing long scientific names, learning endless, minute classifications, and incidentally plucking a few flowers.

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Next as to jealousy, or rather let me call it competition among the various high school subjects for a permanent place in the curriculum. In the New York City high schools we have had until recently three sciences in our course of study—biology in the first year, chemistry or physics in the second and physics or chemistry in the third, with sometimes an elective in the fourth year. Suddenly, however, from out of the west came a gay young Lochinvar, known as general science and then things began to happen. I shall not attempt to enter into a detailed discussion of general science here this evening. That is a topic calling for a special meeting by itself. Suffice it to say that our friends the physicists and chemists, especially the physicists, at once seized upon it as the solution of many of their problems, and in their magnanimous and altruistic spirit worked for its introduction into first-year high school in place of biology. For years the physics and chemistry people have been worried over the immaturity of their pupils and the time it took them to learn elementary physical and chemical principles. They could do none of their cherished advanced work and they certainly were in a quandary. Therefore, when general science appeared over the horizon they seized upon it with avidity as a preparation and a preliminary subject for their own courses. Here, said they, is just the thing to give the first-year pupil the proper apperceptive mass of physical facts and principles upon which we can later construct our real physics and chemistry. Here is our looked-for opportunity. Did they ever consider what this would do to biology? I don't believe they ever deemed it worth thinking about. What I have just said about general science and the physical science folk may seem a trifle exaggerated. If, however, you wish to substantiate it, just look over the general science text-books that are being published and see the relative amount of space devoted to physics, chemistry and biology, or examine the topics taken up in the high schools where general science is now being taught. In one high school in Brooklyn first-year general science is actually being taught by physics and chemistry teachers. That, I think, should show which way the wind is blowing.

Finally, in what way does patriotism affect us? As you all know there has been more or less Bolshevism in the schools, especially in the high schools. The authorities have been at their wits ends to stamp it out and they are going to try the following remedy: They are going to try to conquer Bolshevism by teaching concrete practical American patriotism. They are going to try to show our high school pupils that their political and economic salvation lies in upholding the principles upon which this government is founded. To this no patriotic American would think of objecting or even disagreeing. But what is the specific program to be followed? In the first place economics is to be put into the last year of high school and no student may graduate without passing it. An excellent and patriotic idea, we all agree. Secondly community civics is to be taught in either the first or second year of high school with a minimum requirement of two periods per week for a year, and this is where we are directly affected. Several high schools are giving all of the community civics for four or five periods per week in the first term or first year, and biology is being forced out to make room for it. Now what we biologists contend is, that while community civics should be taught to our pupils, the place for it is in the elementary or junior high schools and not in the regular high schools. I am saying this not simply because I am a biologist, but because I firmly believe that no other subject in the curriculum has those qualities which adapt it so peculiarly to first year high school students as does elementary biology.

I seem to be digressing somewhat from my topic, but I feel that the situation is serious enough to warrant it; and unless we are prepared to meet it, and, meet it right now it will not be at all necessary to consider the kind of botany that is best for our city high schools.

But to get back to my subject. What kind of botany should we teach in New York City high schools? In the first place we should begin with the pupil's environment, the environment of his home, if possible, or the environment of his school or of the neighborhood of his home or school. This, it seems to me, is a fundamental principle, a sort of pedagogical commonplace, but

some teachers seem to consider it practically impossible. In its place they try to construct a course or series of topics which, though vital and necessary in the eyes of the teacher, either have to be forced upon their pupils or given to them camouflaged with all sorts of more or less interesting appendages. And what is the result? The pupils dislike it; they get very little good from the work; the subject becomes unpopular, and finally it has to fight for its very existence. And the whole trouble has been started by its friends.

In most of our high schools where a regular course in botany is given, we find the following methods in vogue: Some try to follow the order of nature. They start with seeds and seedlings and working their way through roots, stems, leaves, flowers, fruit, wind up with a little on forestry. In other schools the start is with made soil composition and chemistry. In others the parts of the plant receive only enough attention to furnish the structural basis for teaching the vital processes. In other schools little or no time is spent upon botany as such; but most of it is occupied with foods and nutrition, bacteria, sanitation and kindred subjects.

In contrast with the above my idea would be to include most of the foregoing topics, but to utilize them by linking them up with the most accessible and obvious botanical object the pupils meet with in their daily lives. Let that object be a tree or shrub or even a potted plant in the class room; but by all means let it be some tangible concrete object, some plant whole, something that they can see, something that they can examine and something that they can watch grow. Let them give it a name, its correct botanical name. There is nothing like a name to give a thing individuality. Let them consider it a member of a class, —a non-resident member if need be—but a member just the same.

If the pupils are fortunate enough to be raising a war garden, then let that be the center or nucleus upon which their botanical work is based. Children of the first-year high school age are very practical and matter-of-fact in many ways, and while it is sometimes a hard job to get them interested in plants in general,

it is the easiest thing in the world to get them interested in some one particular plant. It is like their instinct for keeping pets. The average boy is not so much interested in dogs in general,—in the way a grown-up lover of animals is apt to be. What he cares particularly about is his dog Jack and in his mind all the other dogs in the neighborhood are just plain dogs.

If the object selected for study be some particular tree or shrub, the next thing to do would be to get a picture of it and hang it up in the classroom. If one of my pupils had a camera I would have him take a photograph of it, or in lieu of that I would have one of the pupils make a large drawing of it. At any rate if I could not get the plant into the classroom, I would have its picture there.

Some may raise the objection: What concrete botanical object can be found in the environment of a lower East Side high school boy? What trees, for example? Let us see. A great many of such boys go to either DeWitt Clinton or Commerce or Stuyvesant. None of them have trees or shrubs about their homes and so far as I can recall there are none either near or on their school grounds? But do you realize that DeWitt Clinton, situated as it is in one of the most congested and botanically undesirable sections of the city, is only two blocks from Central Park and many of the boys pass the park on their way home. Commerce also is but a short distance from the park. Every other high school that I can think of either has trees around it or has one or more small parks in its neighborhood. If the high school is in the suburbs or outskirts I would select a tree or shrub from in front of a pupil's home.

But why begin with a tree? For one reason because it is large. There is something about size or bigness that seems to appeal to the average high school pupil. It is his idea of greatness or value. Did you ever notice the smile or look of contempt that comes over a boy's face the first time you hand him a bean to examine? To him a bean is something to eat or to play with, but not to study. It may be all right for elementary school pupils to raise seeds in a cigar box, but not for him.

Another reason for selecting the tree is that it is likewise the

botanical object most familiar to the pupil's parents and therefore the most likely to maintain their respect. On the other hand a seed suggests the farm and the average city parent, thinks, if he thinks about it at all, that farm topics do not belong in a city high school. I may seem to be emphasizing too much the parent's opinion of things, but the strongest ally of any subject is the sympathy and coöperation of the parents. I am not saying this in a spirit of opportunism. But if we believe our subject is worth while and good for the pupils we should do everything possible to disarm criticism from the home and by a judicious amount of tact and resourcefulness lead both parents and school officials around to our way of thinking. There is an old saying and a true one: "You cannot catch flies with vinegar." So do not begin your subject with an altogether strange or uninteresting topic.

In connection with this let me repeat a story I heard a short time ago about a parent's objection to botany. This parent had a daughter studying botany in one of our suburban high schools. One day he asked her the name of the tree in front of his house. The girl did not happen to know the name and the father began to wonder what kind of botany his daughter was studying. Thereupon he called upon his daughter's teacher and politely told him that botany should be thrown out of the schools and something more useful put in its place, since his daughter could not tell one tree from another. In answer to this complaint the teacher said: "My dear Sir, naming and identifying trees is but a small and insignificant part of botany. What we teach is the more fundamental life processes; then later on if we have the time we take up classification." Was that teacher right? Substantially and in the matter of content, yes. But in the manner of approaching his subject or parent as the case may be, I think that he was wrong. The parent's criticism may have been captious and insincere, but he had some grounds for it just the same.

Now as to the way in which we should go about the detailed treatment of the tree or shrub. If I began with the fall term I would start with the leaves and their structure. After that I

would take up respiration, transpiration, photosynthesis, etc. But how would I get enough leaves from a city tree to supply all of my classes, especially when there is a park ordinance against picking leaves? I would not try to get them from the city tree. I would get them in the country during vacation time or on Saturday or Sunday. That, I do not think, is too much to do for one's subject.

How are we to teach the vital processes? Are we to rig up a set of apparatus on one of the park trees for the wonder and admiration of the passing throng? Not at all. I would demonstrate the different functions in the classroom with the same materials and apparatus that I always use, but I would refer everything to our chief object of study and constantly remind the class that they were observing not only what trees in general are doing, but also what one tree in particular was doing in order to keep itself alive.

What about the flowers and fruit of a city tree? That seems an almost unsurmountable obstacle but it is not. Its very difficulty gives zest to its solution. If the average city person knew that oaks and elms had flowers and fruit he would pay little attention to it. But the element of surprise that strikes him upon first being made aware of the fact first excites curiosity, then arouses interest and finally holds his attention. It is not the entirely new that arrests our attention, nor the completely familiar; it is rather the one in connection with the other. It is the old in the midst of the new, as when a traveler hears his own language in a foreign country—or the novel in the midst of the customary—as when we hear a strange tongue spoken in our own country—that attracts attention.

But to get back to the flowers: I would not attempt to teach them at all directly. I would have a chart or drawing of the flowers of that particular tree or shrub. But I would give a complete set of lessons on the most available flower, I could get at that time of the year, but as with the leaves I would constantly refer them to our main object, the tree.

The fruit I would treat in the same way, using the tree's own fruit if available; if not, then some common fruit in its stead.

The next topic is the stem. To teach this we should have cross and longitudinal sections of the same kind of wood. Branches of almost any kind can be secured from the Park Department; their wagons will deliver them to the schools and the boys will be only too glad to saw them up into sections and even varnish them for you. This I have had done several times. All that it requires is a letter to the Park Superintendent. As for the other parts of the tree I would not spend much time on them, but I would put most of the emphasis on the leaves, flowers and fruit; and would treat the rest only enough (in a general city course) to show their functions and their relations to the food making and reproductive organs.

Having thus taken some common shrub or tree as our type form and taught the structure, functions and adaptations of the principal parts, I would then take up any other botanical topic best adapted to the needs and environment of my pupils. With one set of pupils I should emphasize the economic importance of plant products and by-products as food; with another group, especially where there was a manual training department I would spend much time on woods, their kinds, uses, etc.; and so on selecting my topics according to the needs of the various classes.

My idea in advocating the study of some one particular plant as outlined above is this: Heretofore we have been studying seeds with the bean and corn as types, roots with the carrot and parsnip as types, and stems with the oak sections and horsechestnut twigs, but somehow or other the pupils never linked them together. To them the bean did one thing, the carrot another, the horsechestnut twig a third and so on. They did not connect them all with the plant as a whole. On the other hand I think, that if we take one complete object, treat it as a whole and in detail, we will secure greater concentration and develop more fully the fundamental mental processes of analysis and synthesis. We can show the relation of the whole to its parts and the parts to the whole.

Paralleling all of this work and in close connection with it, as one of its most valuable features, I would use to the very fullest

extent possible our botanic gardens and museums. I would not look upon them as a mere adjunct to our work or as factors in a method of teaching, but I would connect them as an integral part of the subject and in one sense the most important part. If the training and botanical knowledge that we give to our pupils is going to amount to anything it must not stop at the end of the first year course in elementary botany. How then are we going to continue it, especially with those pupils who cannot go to college? The answer is, teach them how to use the gardens and the parks. Teach them so that in later years and even during the rest of their high school course, they may find in them a place for recreation and a source of inspiration, a means of avocation, and in some cases, let us hope, a field for serious study. What the public libraries are to the English and history departments, the gardens, parks and museums should be to the biology department.

In conclusion let me say that though the present outlook is none too bright, and we may have to fight for the very existence of our subject, the future is not hopeless. If we believe in our subject let us vitalize it. Let it meet the needs, solve the problems and arouse the interests of our pupils. If we do this, if we vitalize it properly, botany will compel its own recognition.

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CHANGES IN TEACHING BIOLOGY IN OUR HIGH SCHOOLS

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To graduate from a city high school, a pupil is required to pass and receive credit for 17 units of work. Of these units, eight are required of all pupils. Three are in English, three in history and civics and two are given for work in drawing and physical training. The other nine units are selected from the following groups: Three from a foreign language group, two from another language group, two from the mathematics or science group, and the remaining two from any group.